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(12)(19)(CA) **Demande-Application**

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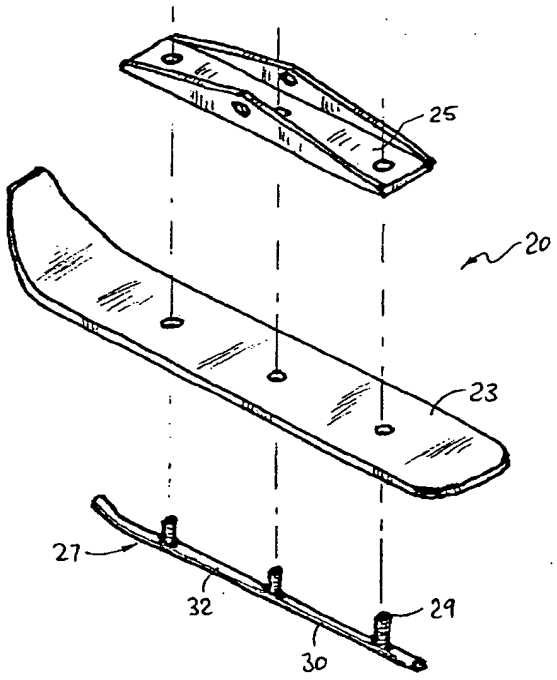
(54) **SKI DE MOTONEIGE**
(54) **SNOWMOBILE SKI**



(57) Profilé de quille pour ski de direction de motoneige. Ce profilé de quille comporte une surface d'usure dans laquelle sont incrustées des particules de diamant. La matrice du diamant est constituée de carbure ou d'un autre matériau dur. Le profilé de quille peut être formé de segments frittés ou de segments préparés sur lesquels le diamant est appliqué sous forme d'enduit.

(57) The keel-bar of a snowmobile steering ski has a wear-surface in which diamond particles are embedded. The matrix for the diamond is carbide or other hard material. The keel-bar can be manufactured in segments by sintering the segments, or by applying the diamond as a coating to a prepared segment.

Abstract of the Disclosure

Title: SNOWMOBILE SKI

The keel-bar of a snowmobile steering ski has a wear-surface in which diamond particles are embedded. The matrix for the diamond is carbide or other hard material. The keel-bar can be manufactured in segments by sintering the segments, or by applying the diamond as a coating to a prepared segment.

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Docket: 737-11

Title: SNOWMOBILE SKI

This invention relates to steering skis of snowmobiles, and especially to keel-bars, which are often fitted underneath the steering skis.

BACKGROUND TO THE INVENTION

The steering ski has a generally flat undersurface, which rides over the snow. For better steering, and to avoid side-slip, it is conventional to provide a keel-bar underneath the ski. The keel-bar protrudes downwards into the snow, and provides a means for positively reacting a lateral or steering force between the ski and the snow.

One of the problems associated with the use of keel-bars is that, while the keel-bar can be expected to last a long time when the snowmobile is riding only on soft snow, the snowmobile sometimes must traverse hard ice, or bare ground, or cross an asphalt road, or encounter some other surface that can be damaging to the ground-engaging components. The difficulty is that the more effective the keel-bar is to provide a large lateral steering force capability, the more the keel-bar is likely to be damaged by occasional traverse over an abusive surface.

When the snowmobile is running over ice, the keel-bar serves also a slightly different purpose, in that the keel-bar can dig in (slightly) into the ice. The keel-bar thus serves to provide lateral force capability on ice, in a similar manner to the blade of an ice-skate. However, prolonged fast running over ice can be even more damaging to the keel-bar than occasional short traverses over asphalt.

Keel-bars are conventionally made from a very hard carbide material, or include insert-segments made from the carbide material.

The invention is aimed at providing a keel-bar which gives more steering "bite" when running on ice, and is less likely to be damaged by running over abusive surfaces.

GENERAL FEATURES OF THE INVENTION

In the invention, the undersurface of the keel-bar unit includes diamond as a component of the material thereof. Usually, in grinding wheels and saw blades and other applications where diamond dust is impregnated into a matrix, the matrix is soft. Preferably, in the invention, in snowmobile skis the matrix material in which the diamond is embedded is not soft, but is, or is comparable in hardness with, the hard carbide material that is conventional on snowmobile skis.

THE INVENTION IN RELATION TO THE PRIOR ART

Impregnating an abrasive-surface with diamond dust or grit, as a way of increasing the abrading capability of the surface, is well known. However, in the case of abrasives, when diamond is used, the diamond is normally set in a relatively soft matrix, not a hard matrix. For grinding wheels, saw blades, and the like, the hard particles provide extra cutting power. Grinding, as a process, works because the hard particles, as they become blunt and dulled, are ripped out of the matrix, and new (sharp) particles are constantly being exposed. The ease with which the dulled, worn particles are ripped out of the matrix depends on the softness of the matrix. Thus, for abrading applications generally, one key to good performance is that there be a large difference between the hardness of the hard particles, and the softness of the matrix material in which the hard particles are carried.

It may be noted that increasing the service life by increasing wear resistance is not a key desideratum of a diamond-impregnated grinding wheel or saw blade. The diamond grit increases the cutting rates that can be achieved: but the diamond grit does not cause the blade to last substantially longer.

In the case of a keel-bar for a snowmobile, however, it is recognised that the diamond material should be impregnated into a hard, i.e not soft, matrix material. In a snowmobile, one of the reasons for including the diamond is to increase the wear life. It is found that adding diamond grit to an already hard material, at least in the snowmobile configuration, can increase wear resistance. The diamond particles are not ripped out quickly, as they become dulled, as they would in a saw blade or grinding wheel, but rather the diamond particles are retained, and remain as part of

the working surface of the keel-bar for a long period. Of course, the diamond particles are ripped out eventually, but each particle remains in place long enough that the overall effect is one of reduced wear rate.

At the same time, as fresh diamond particles are exposed, the particle is sharp, and of course the diamond particle is very hard. It is found that, even though the rate at which fresh particles are exposed, given the hard matrix, is much lower than in a grinding wheel, the rate of fresh exposure is fast enough to give a measurable increase in cutting ability. This is reflected as an increased degree of bite to the steering when running the snowmobile on ice.

In a snowmobile, if the ski is running over soft snow, or even packed snow, very little wear of the ski and the keel-bar takes place. It is the passage of the snowmobile over the occasional asphalt road that wears out the keel-bar. It has been found that adding diamond into the carbide material does increase the service wear performance of the keel-bar.

On the other hand, when the snowmobile is running over hard ice, again adding the diamond is effective, but now, rather, because of the increased steering bite. On ice, generally, the user might be prepared to put up with a small increase in wear rate, if that were the expense of achieving more bite into the ice, i.e more positivity to the steering. With the addition of diamond grit, it has been found that the increased bite is achieved, and yet the rate-of-wear performance on ice is itself also improved, or at least is not reduced.

It is recognised that it is worthwhile to add diamond to the hard carbide material of a snowmobile keel-bar. The presence of the diamond improves both steering bite and wear performance. For most conventional applications where diamond grit has been used, the matrix is soft. It is recognised that, in snowmobiles, steering performance can be improved without loss of wear performance, by adding diamond to the already very hard carbide material.

THE PRIOR ART

The use of carbide runners underneath the keel-bars of snowmobile skis is conventional. An example is shown in patent publication US-5,145,201.

The use of diamond grit in such items as saw blades and grinding wheels is well known. An example of diamond grit applied to the blade of an ice-skate is shown in patent publication US-5,255,929.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

By way of further explanation of the invention, exemplary embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Fig 1 is a pictorial view of a snowmobile steering ski, in which the invention is embodied;
Fig 2 is a cross-section of a keel-bar assembly of the ski of Fig 1.

The apparatuses shown in the accompanying drawings and described below are examples which embody the invention. It should be noted that the scope of the invention is defined by the accompanying claims, and not necessarily by specific features of exemplary embodiments.

Fig 1 shows a steering-ski unit 20 for a snowmobile. The unit 20 includes a ski 23 bolted underneath a suspension plate 25. A keel-assembly 27 is bolted underneath the ski 20. The keel-assembly 27 is secured into the steering-ski unit 20 in the conventional way, i.e by means of studs 29. The studs 29 are welded to a round bar 30, which comprises a keel-bar 32 of the keel-assembly.

As shown in Fig 2, a slot 34 is provided in the keel-bar 32. The slot faces downwards, and has left and right sides 36L,36R, and a roof 38. An insert-segment 40 is brazed, silver-soldered, or welded into the slot 34. The slot extends along the length of the keel-bar 32, and many (e.g ten) insert-segments are provided in the slot. The segments may be evenly pitched along the length of the slot, or may be clustered at

the front and rear ends of the slot.

The insert-segment 40 is rectangular, having left and right side-faces 43L,43R, a top-face 45, and a bottom face 47. The bottom face 47 is provided with a diamond-grit-laden coating 49.

The matrix material of the insert-segments is carbide material, of the kind that is conventionally used as the material for such inserts on snowmobile skis. In the segments as shown, diamond grit is added into the carbide.

The material that is used as the matrix for the diamond should have a hardness of at least xxx. Carbide material, as described, typically has a hardness of xxx.

To manufacture the segments, one technique is to impregnate the surface of an already-prepared carbide segment with diamond particles, which can be done for example by one of the conventional industrial techniques for applying coatings of a powder material to a surface.

Alternatively, the whole segment may be manufactured by sintering a powder, in which the powder is a mixture of carbide particles and diamond particles.

Alternatively again, a carbide segment can be prepared, and then the coating of diamond-particles-included-in-a-matrix can be powder-sintered onto the carbide body of the segment. In such a case, i.e where the diamond material is included in a powder matrix that is sintered onto an already-prepared segment body, that body itself need not be of hard material. The body of the segment serves mainly for securing the segment into the slot 34, and is not subjected to wear.

As part of the manufacturing process, the segment should be tempered after sintering. Chemical hardeners, such as xxx, can be included in the powder mixture that is sintered.

The size of each segment can be determined by the convenience of the manufacturing process. Whether many short segments are provided, or just a few

longer segments, is determined by the economics of manufacture. The hard segments can be quite brittle, and short segments are generally more robust, in that a long segment might crack. A typical preferred size of the segment would be approximately 2 cm long by 1 cm high, and 2 or 3 mm thick.

Claims

CLAIM 1. Keel-assembly for a snowmobile ski, wherein:
the keel-assembly has an undersurface, being a surface which, in operation of the snowmobile, faces downwards, and is in direct rubbing engagement with the ground surface over which the snowmobile is operating;
the undersurface of the keel-assembly includes diamond as a component of the material of the undersurface.

CLAIM 2. Apparatus of claim 1, wherein:
the keel-assembly includes a keel-bar;
the keel-assembly includes a means for fixing the keel-bar underneath the ski;
the keel-bar has a downward-facing slot, running lengthwise along the keel-bar;
the keel-assembly includes insert-segments, which are located in the slots in the keel-bar, and which, in operation of the snowmobile, extend below the keel-bar;
the undersurface of the keel-assembly is an undersurface of the insert-segments;
and the insert-segments include the diamond as a component of the material thereof.

CLAIM 3. Apparatus of claim 2, wherein the keel-bar is made of steel.

CLAIM 4. Apparatus of claim 2, wherein the insert-segments include a matrix of hard carbide material, in which the diamond is integrated.

CLAIM 5. Apparatus of claim 2, wherein the insert-segments include a matrix, in which the diamond is integrated, of a material that is comparable in hardness to carbide material.

CLAIM 6. Apparatus of claim 2, wherein the insert-segments include a matrix, in which the diamond is integrated, of a material that has a hardness of xxx.

CLAIM 7. Apparatus of claim 2, wherein the insert-segments were formed by sintering material in powder form, the diamond being included as diamond grit that is a component of the powder.

CLAIM 8. Apparatus of claim 7, wherein the insert-segments were tempered after

sintering.

CLAIM 9. Apparatus of claim 2, wherein the insert-segments are provided with a coating that was formed by sintering material in powder form, the diamond being included as diamond grit that is a component of the powder.

CLAIM 10. Apparatus of claim 9, wherein the material in powder form is a mixture that also includes powdered carbide material.

CLAIM 11. Apparatus of claim 9, wherein the material in powder form is a mixture that also includes chemical hardeners xxx.

CLAIM 12. Apparatus of claim 2, wherein the segments are many, and the many segments are pitched along the length of the slot in a spaced-apart configuration.

CLAIM 13. Apparatus of claim 12, wherein the slot is continuous, and extends along at least most of the length of the keel-bar.

CLAIM 14. Apparatus of claim 1, wherein the diamond is of industrial grade.

CLAIM 15. Apparatus of claim 1, wherein the diamond is synthetic.

CLAIM 16. A snowmobile, having a steering ski, the ski having a downwards-facing snow-surface-engaging under-face, wherein:

the ski is fitted with a keel-assembly, which includes a keel-bar;

the ski has an under-face, which, in operation of the snowmobile, faces downwards, and is in direct rubbing engagement with the ground surface over which the snowmobile is operating;

the keel-bar assembly includes a means for attaching the keel-bar underneath the under-face of the ski;

the keel-bar is formed with a lengthwise slot;

the slot has opposed parallel side walls, and a roof, and an open mouth opposite the floor, which is open downwards when the ski is in use;

the apparatus includes several diamond-carrying segments, disposed along the length

of the slot;

each diamond-carrying segment comprises a piece of flat, parallel-sided sheet metal, the profile of the segment being generally rectangular;

a bottom face of the segment has diamond grit deposited thereon;

the parallel sides of the segment engage the sides of slot, and a top face of the segment lies against the roof of the slot.

FIG 1

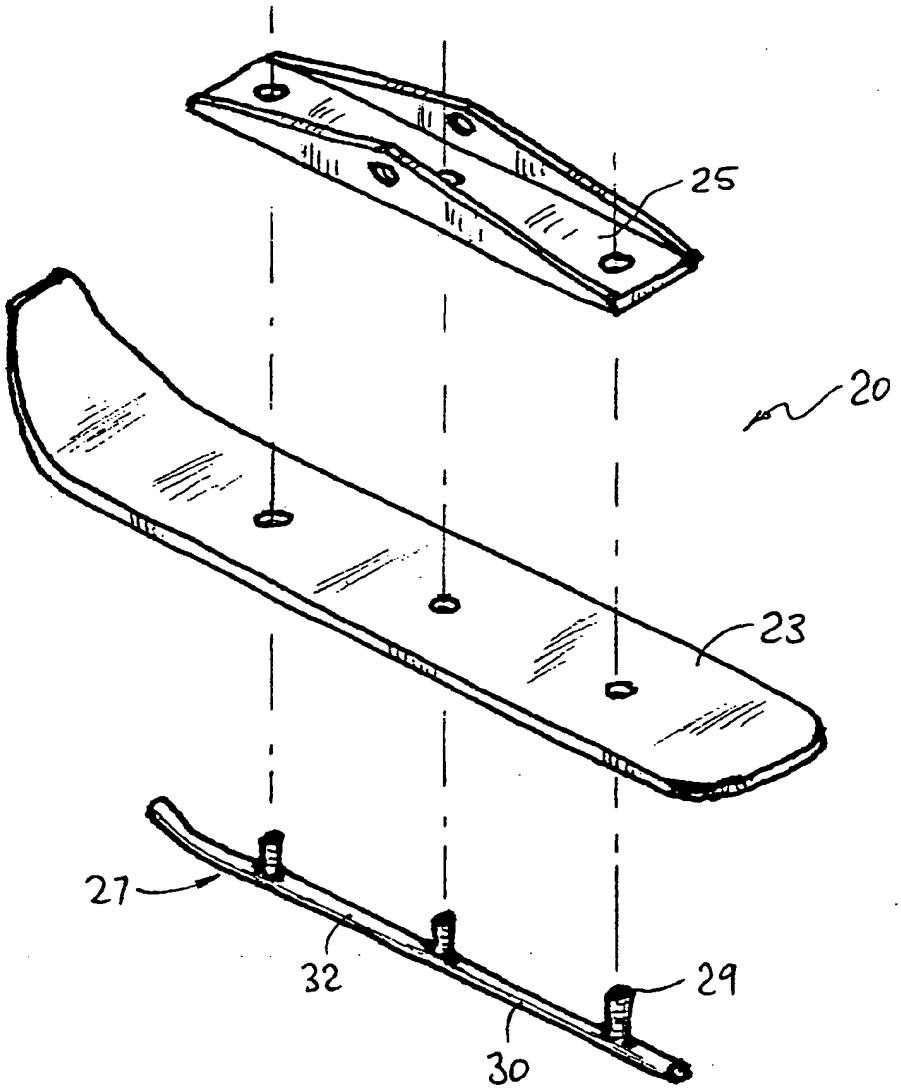

FIG 2